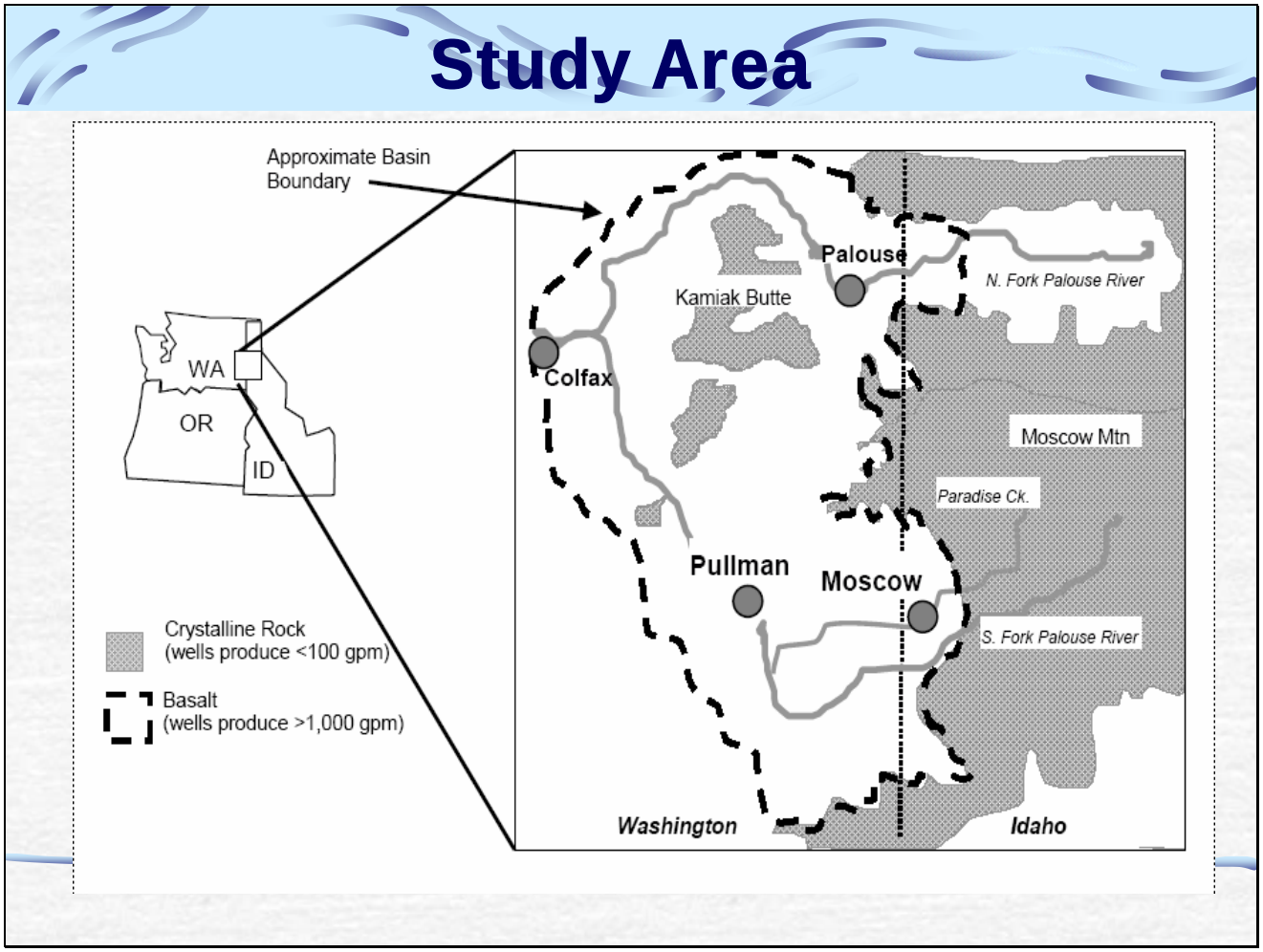
Study Area



The Palouse Basin Aquifer Committee

The City of Colfax became the newest member of the Palouse Basin Aquifer Committee in 2003, joining the cities of Moscow and Pullman, the counties of Latah and Whitman and the University of Idaho and Washington State University. Colfax joined the two cities and the two universities as a major water purveyor and a pumper of deep aquifer water.

Concern in the late 1960s over declining groundwater levels in the local aquifers led several water professionals at UI and WSU to begin meeting to seek understand of the cause and to find a solution. In the 1970s the group was joined by representatives from the cities of Moscow and Pullman and became know as the Pullman-Moscow Water Resources Committee. In the early 1980's it disbanded but was re-energized in 1987 by renewed concerns about declining deep aquifer water levels. The two counties were invited to join and the name was changed to the Palouse Basin Aquifer Committee, commonly called PBAC. The purpose of PBAC has always been to provide a forum for the stakeholders to work together to secure a reliable long-term, quality

water supply for all users in the Palouse Basin region. PBAC is a voluntary, cooperative, multi-jurisdictional committee which is guided by an Intergovernmental Agreement signed by the seven stakeholders forming the committee and an Interagency Agreement signed by the Idaho Department of Water Resources (IDWR) and the Washington Ecology (WDOE). PBAC has crafted a groundwater management plan for the region. This groundwater management plan, know as the Plan, provides the background and the framework for PBAC while enunciating PBAC's mission, "to provide for future beneficial use of the basin groundwater without depleting the basin aquifers while protecting the quality of the water." An excellent working relationship across the state line and between entities has helped PBAC to stay focused on its mission and primary goals.

A primary goal for achieving this mission has been, and is, to stabilize the declining deep aquifer water levels. A joint USGS and University of Idaho study in 1989 resulted in the construction of a model for the Moscow-Pullman Basin area. It concluded that stabilizing pumping from the Grande Ronde Aquifer System (GRAS) would also stabilize water levels in ten to fifteen years. After 10 years of holding deep aquifer pumping essentially constant without seeing any change in the rate of decline in water levels, PBAC conclude that supplemental recharge water would be needed to stabilize the GRAS water levels. PBAC sponsored research in this period concluded that actual recharge to the deep aquifer was significantly less than that used in the model. As an expression of its commitment to this task, in 1999 PBAC refined its goals to state that it would stabilize the Grande Ronde Aquifer System water levels by 2020. At the same time the major pumping entities, Pullman, Moscow, WSU and UI began committing $20,000 each per year for critical research designed to clarify basic geohydrology parameters so that PBAC could determine the best and most economical method for enhancing recharge to the deep aquifer system. The enhanced recharge, if done with understanding of basin parameters, should result in stabilization of the GRAS water levels. An interim goal is to determine a plan for accomplishing this by 2010.

Summary of the Palouse Basin Water Supply Challenge

The communities of the Palouse region and the surrounding rural residences rely on groundwater from the Palouse Groundwater Basin as their sole source of drinking water. Recharge to the shallow or Wanapum Aquifer System has kept water levels reasonably stable confirming that recharge to the shallow aquifer system continues to be at least equal to pumping from it. This aquifer system supplies water to most rural residences located over the basin.

Water levels in the deeper or Grande Ronde Aquifer System (GRAS), which is the main source of water for local municipal water systems, have been historically declining at a rate of about one and a half feet per year. However, in the past couple years the rate of decline in a number of area wells has dropped to less than one foot per year. This is a very encouraging trend that PBAC is monitoring closely. A groundwater model of the Palouse Basin constructed in 1989 predicted that water levels would stabilize in 10 to 15 years if pumping were held constant. Several more years of monitoring data

corroborated by related research are needed before PBAC can speak definitively as to whether this change in the rate of decline is the result of recharge to the deep aquifer system balancing the stabilized pumping.
Although there are hundreds of feet of water in the GRAS below the entity pumps, PBAC continues to work proactively to stabilizing the GRAS water levels and ensure a long-term water supply for the region while there is time to systematically determine the best plan for accomplishing this. The subsurface geology has turned out to be much more complex than anyone imagined. Determining its complexities and the impacts on water movement is proving to be a challenging task. After years of study, local experts still do not know the amount and extent of recharge to the deep aquifer; they do not know the direction the ground water is moving, the extent of the basin or where the water is leaving the basin. Each year there is significant progress made but it is frustratingly slow compared to expectations.
A secondary PBAC goal is procuring external matching funding to facilitate the necessary research and pilot projects to clarify the best options available to regional entities for achieving the PBAC goals. In December, 2003, PBAC receive notification of a federal appropriation for $100,000 through EPA to further its monitoring and research program.

¶ PBAC continues to work with faculty and students at both the University of Idaho and Washington State University to accomplish the desired research in an effective manner that benefits all parties. Monitoring and interpreting water levels; sampling, analyzing and dating water from different aquifers; studying and presenting the subsurface hydrogeology and planning for various pilot projects is encompassed in current PBAC research which is covered more fully below.

Groundwater pumping by the four major pumping entities from the Grande Ronde Aquifer System has averaged about 2.4 billion gallons a year for the past 14 years. The City of Moscow pumped about 300 million gallons of shallow aquifer water for use as part of its municipal water supply in 2003. Also in 2003 the University of Idaho sprinkled approximately 100 million gallons of recycled water from the Moscow waste water treatment plant on the UI golf course, arboretum and other campus green space.

In the past four years this research has greatly advanced the understanding of the Palouse Basin hydrogeology but it has also raised additional questions as the complexity of the subsurface basin geology began to unfold. The impact of multiple flows of basalt flooding the basin area from the southwest and west along with the accumulation of sedimentary interbeds and some folding and minor faulting are still being unraveled. PBAC purchased 24 sensitive water level recording devices which have greatly expanded understand of the groundwater interconnections as well as the lack of interconnections between some wells in different pumping centers. These loggers record the starting and stopping of pumps over great distances where wells are in the same aquifer. Carefully planned pump tests can tell knowledgeable researchers much about the aquifers and their boundaries. Some of the major findings from the PBAC sponsored research in the past four years includes:

Osiensky-Keller Research Project (the OK Project)

This three-year comprehensive study starting in the fall of 1999 used improved equipment and techniques, set out to more clearly define the basin boundaries, the recharge to the basin, the movement of ground water into and between aquifer systems, the ground water losses to the basin and the connectivity between pumping centers within the basin. The project was extended a fourth year to expand the research into the Colfax area and monitor wells previously considered outside the Palouse Basin.

Five theses have been completed detailing study procedures and results on specific OK Project goals and two more are in the process of being completed. A separate dissertation drew on OK Project results. More detailed summary materials and the theses are available for review.

As a result of PBAC sponsored research the OK Project has accomplished the following:

- Expanded significantly the list of production well logs and their completion intervals. This data has delineated the locations of the water bearing strata and clarified more accurately which strata are sources for producing wells and which are not.
- Expanded collection of isotopic signatures of water samples throughout the basin. This has confirmed the old age of deep aquifer water, the existence of recharge to the shallow aquifer, and the almost complete absence of springs from the deep aquifer.
- Developed a comprehensive ground water monitoring program for the Grande Ronde aquifer system. The program significantly increased the number of basin wells being sampled for ground water level and geochemical data. Using PBAC purchased loggers, the OK Project has greatly improved the quantity and quality of ground water level data. More well logs have been added to the basin files. These data are now being made available, to the benefit of all future studies, to researchers, students and area residents interested in basin hydrogeology.
- Cleaned mud out of the critical DOE test well, half way between Pullman and Moscow, which was flooded by a high flow of Paradise Creek. The casing has now been extended to prevent any future flooding of the test well and it has been restored as a monitoring well. One of PBAC's new recording devices is now gathering valuable water level data from the well on a continuous basis.
- Completed a detailed investigation of spring discharges in the Union Flat Creek and South Fork Palouse River drainages.
- Documented that the few springs discharging into the Snake River are from the shallow aquifer system and not the Grande Ronde aquifer system.
- Determined by geochemistry that all basin area springs are deriving their water either from perched water tables in the soil horizons or from the shallow Wanapum aquifer system. However, recent sampling of springs in the Colfax area has

determined that these discharge directly from the deeper Grande Ronde aquifer system. This means that any natural loses from the Grande Ronde aquifer system to springs and/or seepage to streams is significantly to the west and north of previously speculated losses. This is another contradiction to previous hypotheses that assumed considerable losses from the Grande Ronde aquifer system occurred along the Snake River and other area streams.

- Determined that the base flow for a number of local streams is comprised of shallow aquifer water.
- Ran several large-scale aquifer pumping tests resulting in a much better understanding of basin boundaries and pumping area interconnectivity.
- Documented a hydraulic connection across the Kamiak Gap and redefined the northern and northwestern extent of the basin. The Palouse Basin is now known to be much larger than previously thought. The northern and northwestern boundaries are still to be determined.
- Documented basin-wide hydraulic responses to pumping events. Loggers in wells in Palouse, Washington recorded pumping events in both Moscow and Pullman but no pumping events in either Moscow or Pullman were observed on water level recorders in the other community. An unknown barrier is now presumed to exist between a Moscow subbasin and a Pullman subbasin that results in only indirect and time-delayed connectivity.
- Showed the lack of hydraulic connection between the shallow Wanapum and the deeper Grande Ronde aquifer systems during pumping tests.

Moscow Mountain Front Runoff Study

PBAC funded a study which evaluated existing runoff and water quality data from historical studies in the Paradise Creek watershed above the USGS gaging station in west Moscow. Probablistic hydrographs were constructed to show the amount of runoff available and the water quality in a typical year. Estimates were also made of infiltration and the runoff for the South Fork of the Palouse River. This study shows the quantities of runoff available for possible water right applications from PBAC entities that could be used to supplement current ground water pumping.

Continuing PBAC Research is:

- Expanding the ground water monitoring network to the Snake River, into the Colfax area and into the Klemgard Park area along Union Flat Creek.
- Designing and conducting additional large-scale aquifer tests to help clarify some puzzling data from previous tests and to help delineate potential capture zones for possible artificial recharge sites. These include infiltration basins and passive and active injection wells.

- Evaluating the spatial distribution of ground water age dates relative to the ground water levels and the distances along the flow paths in order to delineate ground water movement.
- Mapping and collecting water samples from springs along the Palouse River downstream of Colfax, from City of Colfax wells, and from any other deep wells that can be located in the Colfax area.
- Continuing to analyze the rapidly expanding database of ground water levels and other ground water parameters as additional wells are logged and extensive water level measurements are recorded.
- Plotting historical water levels, for Moscow and Pullman wells with records dating back to the 1920s. These hydrographs strongly suggest the existence of significant vertical gradients back to the early stages of pumpage. These gradients imply natural ground water flow from recharge areas to discharge areas within the Grande Ronde under natural (predevelopment) conditions.

Other PBAC Funded Projects

- Designing and beginning compilation of a GIS database for the Basin. This will bring together most of the scattered ground water related data and place it in easily accessible layers covering the basin.
- Lithologic mapping of the Moscow area to clarify what is know of subsurface geology and to provide probable areas for recharge sites.
- Geologic mapping of a portion of Whitman County. This will result in an additional 24000 scale geological map which will greatly aid future work and can be made available to the public and others.
- Preparatory work for a passive drainage well pilot project. This involves designing a passive drainage well or well field connecting the shallow aquifer system to the deep aquifer system that will allow monitoring of recharge to the deep aquifer from the shallow aquifer. The planned site is the UI Ground Water Test Site.
- Drilling of several monitoring wells and establishment of a multi-aquifer monitoring facility. This project will be the first monitoring facility designed, drilled and equipped for optimal collection of geohydrologic data within the basin.

[Graphic of Palouse Basin location map and brief explanation]

[Graphic of Palouse Basin X-section diagram and brief explanation]

PBAC's Current Priorities and Workplan

Understanding the Palouse Basin geohydrology well enough to make decisions about how best to stabilize the GRAS water levels and ensure a dependable long-term water supply for the region continues to be the top PBAC priority. Specific questions being

addressed under this topic include:

- *Will the deep aquifer actually stabilize if entities continue to hold pumping constant?* This is primarily a water level monitoring question. A specific PBAC priority is to continue the collection of high quality water level data and track the current flattening of the water level declines in many of the basin's deep aquifer wells.
- *What is the best way or combination of ways to ensure adequate availability of water for future populations in the Palouse Basin region?* PBAC knows that recharge to the deep aquifer is less than what was estimated 15 years ago for the basin model. For the moment implementation of additional conservation practices, greater efficiency of use of ground water, switching pumping from the deep aquifer to the shallow aquifer and recycling of water will permit entities to maintain current levels of pumping from the deep aquifer at a constant. Eventually, however, supplemental sources of water will be needed. PBAC is evaluating the most economic sources for this supplemental water supply. The shallow aquifer in the Moscow area is a source being used by the City of Moscow to relieve pumping pressure on the deep aquifer and it could be used to increase recharge to the deep aquifer.
  More extensive monitoring of the shallow aquifer water levels, a study of possible adverse impacts from mixing the shallow aquifer water with deep aquifer water in a connector well and a pilot project to test control of the recharge process are all in PBAC's planning for the near future.
- *Is it possible to augment recharge to the deep aquifer in the Moscow-Pullman area by increasing recharge in the vicinity of the North Fork of the Palouse River?* PBAC research indicates a hydraulic connection between City of Palouse wells and wells in both Pullman and Moscow. At this time it is unknown whether the ground water is moving from the Palouse area toward the Moscow and Pullman areas or moving from the Moscow and Pullman areas northwest past Palouse. The proposed monitoring well field to be located north of Moscow and more detailed analyses of pump test data are expected to clarify whether Palouse River water can be used to enhance recharge to the Grande Ronde Aquifer System in the Moscow and Pullman areas.

- *What is the most efficient way to augment recharge to the deep aquifer in the Palouse Basin?* This is related to the previous two questions. PBAC research has determined that there are large quantities of unappropriated surface water in Paradise Creek and the South Fork of the Palouse River that could be utilized either directly or for recharge during the fall, winter and spring periods of most years. There are significant costs associated with cleaning up these waters for direct use or even for infiltration into one of the aquifer systems. Over 60 percent of all the water pumped for the ground for municipal use is treated at the Moscow waste water treatment plant and then discharged to Paradise Creek. This water, for a price, could be further polished and either used directly or recharged to the aquifer systems by several means. An important role of PBAC is educating members and the communities to the options that are available and new technology being used elsewhere that might facilitate procuring supplemental water for the area use.

- *Procuring matching funds to expand and facilitate the ongoing PBAC research.* PBAC received a federal appropriation through EPA for $100,000 in December, 2003 to further its monitoring and research program. There is the possibility of addition grants in future years under this program. However, there is considerable paper work involved in obtaining and utilizing these funds which PBAC needs to plan for. Two years ago the State of Idaho legislature authorized $100,000 through the Department of Water Resources for helping PBAC stabilize the Grande Ronde Aquifer System water levels and ensure a long-term quality water supply for the Idaho portion of the basin. These funds were temporarily retracted when the Governor mandated cutbacks for all State of Idaho agencies. Additional funds for a water quality study with the Idaho Department of Environmental Quality were also lost in the cutbacks. PBAC is working with legislators and state agencies to get the funding restored as soon as the economic downturn is over.
- *Encouraging entities in their individual efforts to hold constant and reduce deep aquifer pumping.* The various entities have different opportunities for improving conservation and efficient use of water. Washington State University has been very effective at increasing the efficiency of water use on campus and has managed to reduce deep aquifer pumping for a number of years. WSU and the City of Pullman are working together with the Washington legislature to fund a reclaimed water system for irrigation green space that will permit reducing deep aquifer pumping by hundreds of millions of gallons. The reclaimed waste water treatment plant effluent will be polished and then pumped to play fields, green space and the WSU golf course for use in place of deep aquifer water.

  The University of Idaho in cooperation with the City of Moscow has been very successful in displacing deep aquifer pumping for green space irrigation with recycled water. Most UI playfields, green space, golf course and arboretum are now irrigated with reclaimed water from the City of Moscow waste water treatment plant. The City of Moscow has upgraded its green sand filtration plant so that it can utilize more shallow aquifer water for municipal use. This has allowed Moscow to hold deep aquifer pumping constant while continuing to supply water to a growing population. Moscow also has an active water department that works with Moscow residents to install water conservation devices and help educate community members on ways to be more efficient in using water. Moscow is planning to take further steps to reduce per capita water use through the hiring of a consultant to evaluate options for additional conservation and efficient use of water.